



PATENT

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November 30, 2001
Date

Kelli Endreson
Kelli Endreson

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants : Kyle M. Hanson, Robert A. Weaver, Jerry Simchuk and
Raymon F. Thompson

Application No. : 09/882,309 Confirmation No.: 7064

Filed : June 14, 2001

For : DIFFUSER WITH SPIRAL OPENING PATTERN FOR
ELECTROPLATING REACTOR VESSEL

Examiner : Wesley Nicholas

Art Unit : 1741

Docket No. : 291958123US1

Date : October 4, 2001

Commissioner for Patents
Washington, DC 20231

DECLARATION OF KYLE M. HANSON UNDER 37 C.F.R. § 1.131

Dear Commissioner:

I, Kyle M. Hanson, declare and state that:

1. I am a joint inventor of the invention described and claimed in U.S. Patent Application No. 09/882,309 filed June 14, 2001, which is a continuation of U.S. Patent Application No. 09/351,864, now issued as U.S. Patent No. 6,254,742. This declaration establishes conception and reduction to practice of the invention in this country before May 29, 1998, and thus before the U.S. filing date of U.S. Patent No. 6,080,288 issued to Schwartz et al., and U.S. Patent No. 6,103,085 issued to Woo et al.

2. Before May 29, 1998, my co-inventors and I conceived the invention presented in claims 17, 26, 27, 28 and 37 (see enclosed Preliminary Amendment, filed herewith) of the above-captioned patent application. Our conception and reduction to practice of the invention are corroborated by (a) redacted drawings (attached to this Declaration as Exhibits A and B), and (b) redacted test results (attached to this Declaration as Exhibit C) corresponding to tests completed using a diffuser manufactured in accordance with one of the redacted drawings.

3. As shown in Exhibits A, B and C, my co-inventors and I conceived and reduced to practice an apparatus for processing a microelectronic workpiece and a method for using the apparatus. In one embodiment set forth in claim 17, the apparatus is for processing a microelectronic workpiece in a process chamber configured to contain a process fluid, with the process chamber having an electrode support configured to support an electrode at a first position within the process chamber, and a microelectronic workpiece support configured to support a microelectronic workpiece at a second position spaced apart from the first position. The apparatus includes a diffusion plate member configured to be positioned between the first position and the second position, with the diffusion plate member having a first surface facing toward the first position and a second surface facing toward the second position (see Exhibit A, drawings labeled ATG0230, ATG0231, and ATG0232). The diffusion plate member further includes a plurality of openings extending through the diffusion plate member from the first surface to the second surface, with the openings being arranged in at least one spiral pattern (see Exhibit B, drawings labeled ATG0230, ATG0231, and ATG0232, identical to the respective drawings of Exhibit A, with the exception of the addition of spiral lines sketched in by hand after the creation date of the drawings to highlight the spiral nature of the hole patterns). At least one of the diffusion plate member and the microelectronic workpiece support is rotatable relative to the other.

4. My co-inventors and I also conceived a further embodiment, set forth in claim 26, wherein the diffusion plate member of claim 17 is positioned in a process chamber configured to contain a process fluid, and wherein the process chamber has an electrode support configured to support an electrode at a first position, the process chamber further having a microelectronic workpiece support configured to support a

microelectronic workpiece at a second position spaced apart from the first position (Exhibit A, drawing labeled 100T0033).

5. My co-inventors and I also conceived of a further embodiment, set forth in claim 27, wherein the diffusion plate member is positioned in a process chamber, and wherein the process chamber includes a second vessel disposed inwardly from a first vessel, the second vessel having an upper edge defining a weir over which the process fluid flows into the first vessel, and wherein an electrode is disposed within the second vessel (Exhibit A, drawing labeled 100T0033).

6. My co-inventors and I conceived of still a further embodiment (set forth in claim 28) of a process chamber for processing a microelectronic workpiece that includes a first vessel (Exhibit A, drawing labeled 100T0033), and a second vessel disposed inwardly from the first vessel and configured to hold a process fluid, the second vessel having an upper edge defining a weir over which the process fluid can flow into the first vessel (Id.). The process chamber includes an electrode support configured to support an electrode at a first position within the second vessel (Id.) and a microelectronic workpiece support positioned proximate to the second vessel to support a microelectronic workpiece at a second position spaced apart from the first position (Id.). The process chamber still further includes a diffusion plate member positioned between the first position and the second position with the diffusion plate member having a first surface facing toward the first position, a second surface facing toward the second position, and a plurality of openings extending through the diffusion plate member from the first surface to the second surface with the openings being arranged in at least one spiral pattern, and with at least one of the diffusion plate member and the microelectronic workpiece support being rotatable relative to the other (Exhibits A and B, drawings labeled ATG0230, ATG0231, and ATG0232).

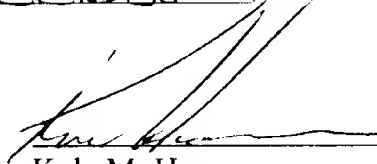
7. My co-inventors and I conceived of yet a further embodiment (set forth in claim 37) of a method for processing a microelectronic workpiece that includes disposing the microelectronic workpiece in a vessel (Exhibit A, drawing labeled 100T0033), positioning a first electrode proximate to the microelectronic workpiece (id.), coupling a second electrode to the microelectronic workpiece (id.), and disposing a diffusion plate member between the first electrode and the microelectronic workpiece

(id.). The method further includes directing a flow of processing fluid toward the microelectronic workpiece through a plurality of openings in the diffusion plate member, with the openings being arranged along a spiral path (Exhibits A and B, drawings labeled ATG0230, ATG0231, and ATG0232), and rotating at least one of the diffusion plate member and the microelectronic workpiece relative to the other while directing the flow of processing fluid through the openings in the diffusion plate member.

8. My co-inventors and I reduced the invention to practice by directing the fabrication of diffusion plate members in accordance with the foregoing claims and testing the diffusion plate members in a process chamber supporting a microelectronic workpiece. My co-inventors and I directed the fabrication of a diffusion plate member (generally similar to that shown in Exhibit A, drawing labeled ATG0232), installed the diffusion plate member in a processing chamber (generally similar to that shown in Exhibit A, drawing labeled 100T0033) and applied a conductive coating to a microelectronic workpiece in the processing chamber. We then measured the sheet resistance of the microelectronic workpiece plated in the processing chamber. We obtained raw data corresponding to sheet resistance values for 49 points on the conductive material applied to the microelectronic workpiece (Exhibit C, data sheet labeled Prometrix OmniMap RS30, 09:24). These data were interpolated to produce a matrix of 121 points (Exhibit C, data sheets labeled Prometrix OmniMap R530, 11:05. The interpolated data were used to produce a contour plot indicating sheet resistance over the surface of the microelectronic workpiece (Exhibit C, contour plot labeled Prometrix OmniMap R530, 09:37).

9. I further declare that all statements herein made of my own knowledge are true, and that all statements made on information or belief are believed to be true; and further, that the statements are made with the knowledge that the making of willful or false statements or the like is punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and may jeopardize the validity of any patent issuing from this patent application.

Dated this 30 day of October, 2001.



Kyle M. Hanson

Residence : City of Kalispell
State of Montana
Citizenship : United States
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Kalispell, Montana 59901



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants : Kyle M. Hanson, Robert A. Weaver, Jerry Simchuk and
Raymon F. Thompson

Application No. : 09/882,309 Confirmation No.: 7064

Filed : June 14, 2001

For : DIFFUSER WITH SPIRAL OPENING PATTERN FOR
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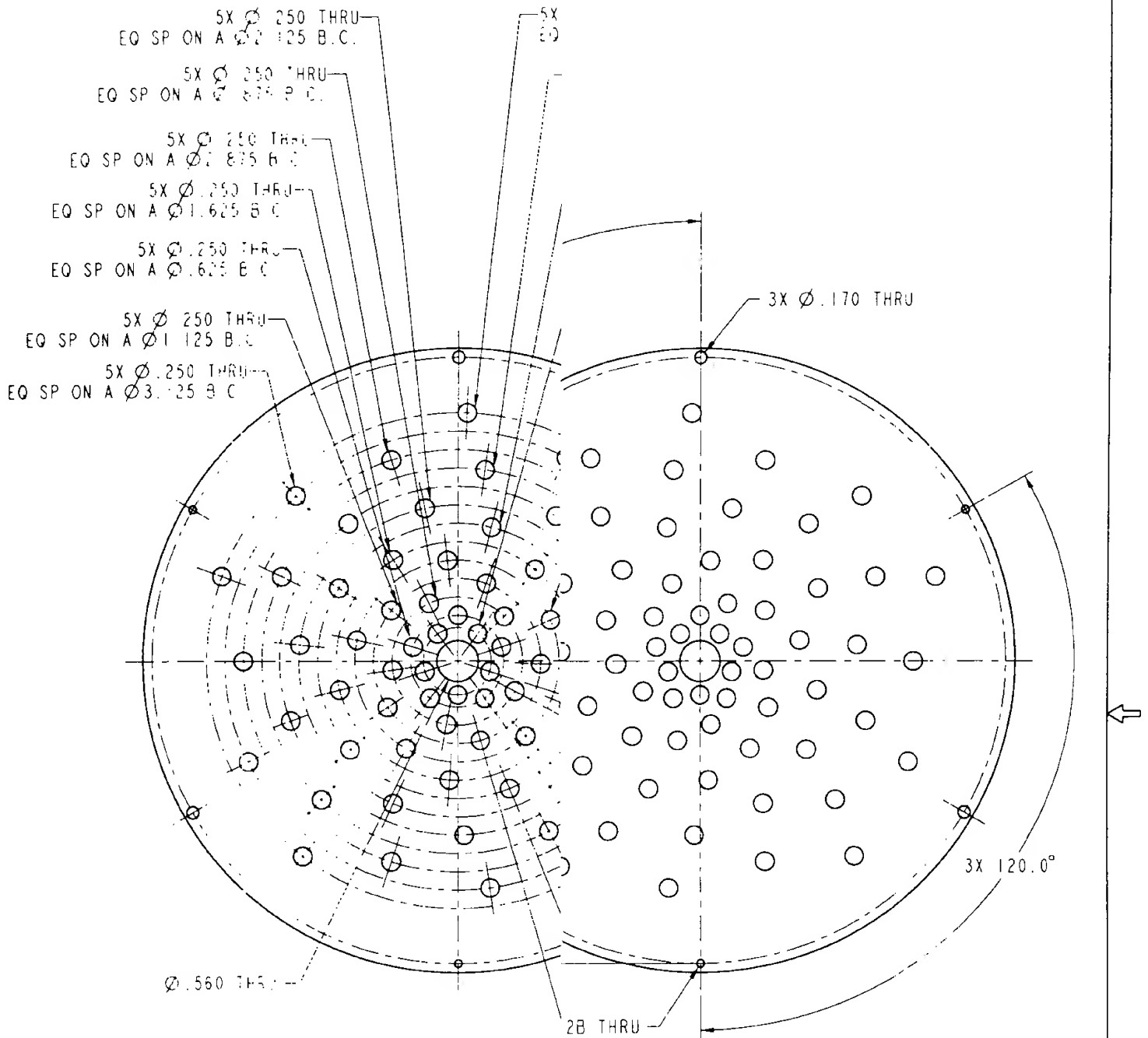
Date : October 4, 2001

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Washington, DC 20231

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EXHIBIT A

REVISIONS		DISPOSITION	DATE	APPROV
DESCRIPTION	(SCRAP, REWORK, USE AS IS)			

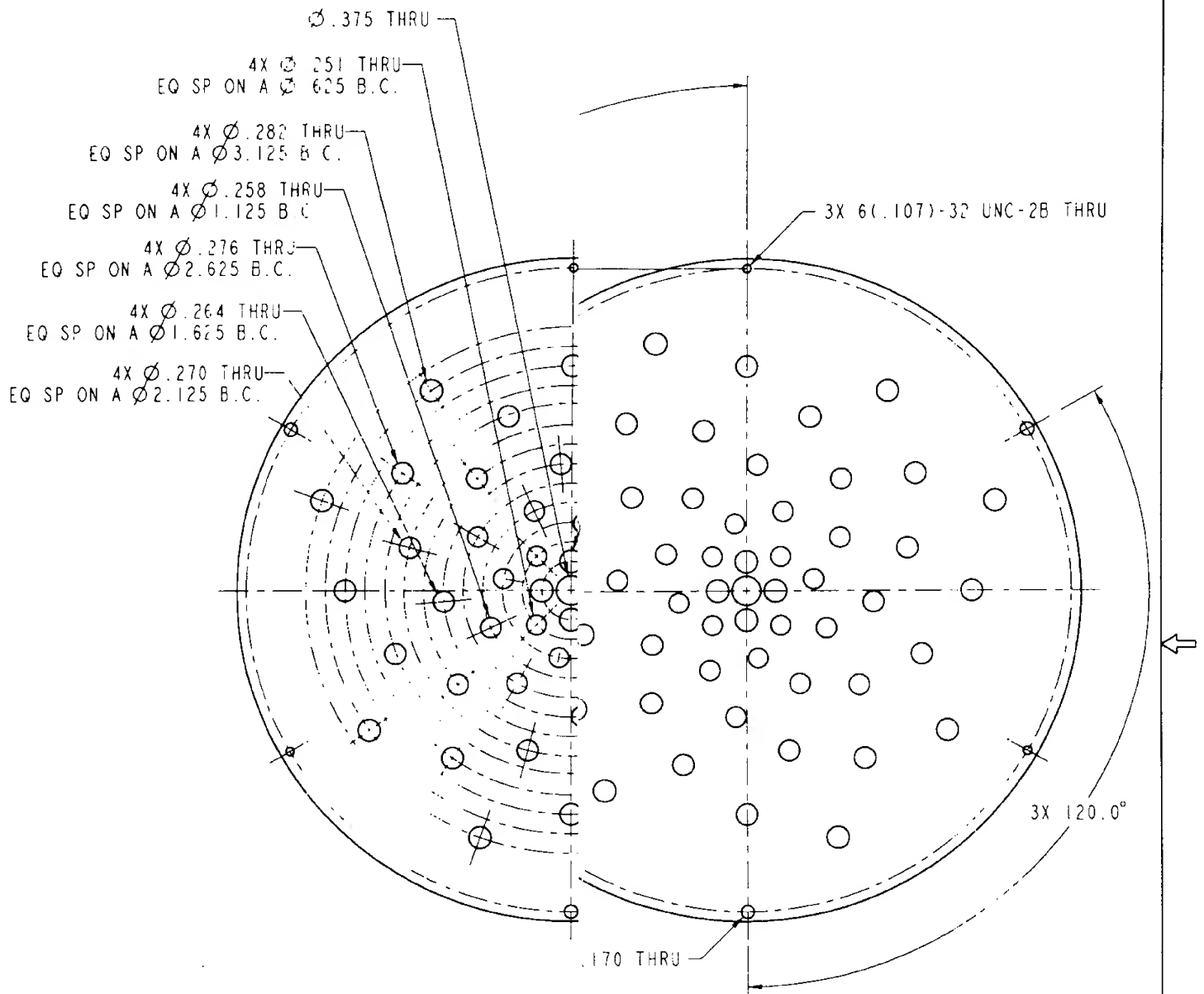


NOTE TWO SETS OF FIVE SPIRAL HOLE PATTERNS EQUALLY SPACED.

TOLERANCES UNLESS NOTED
 X = ± .020
 XX = ± .010
 ANGULARITY = ± 5°
 RAK CORNERS = .010 MAX
 HOLE RADIUS = .015 MAX
 CHINED SURFACES
 DIMENSIONS ARE IN INCHES
 LESS NOTED

MATERIAL	NPP, SHEET 1/8"		
FINISH	-		
MODEL NO SHOWN	ATG0230		
SEMITOOL TM KALISPELL, MT DIFFUSER, SERIES 1			
SIZE	1/8" X 1/8"	DWG NO	ATG0230
DATE	0500	SHEET 1 of 1	

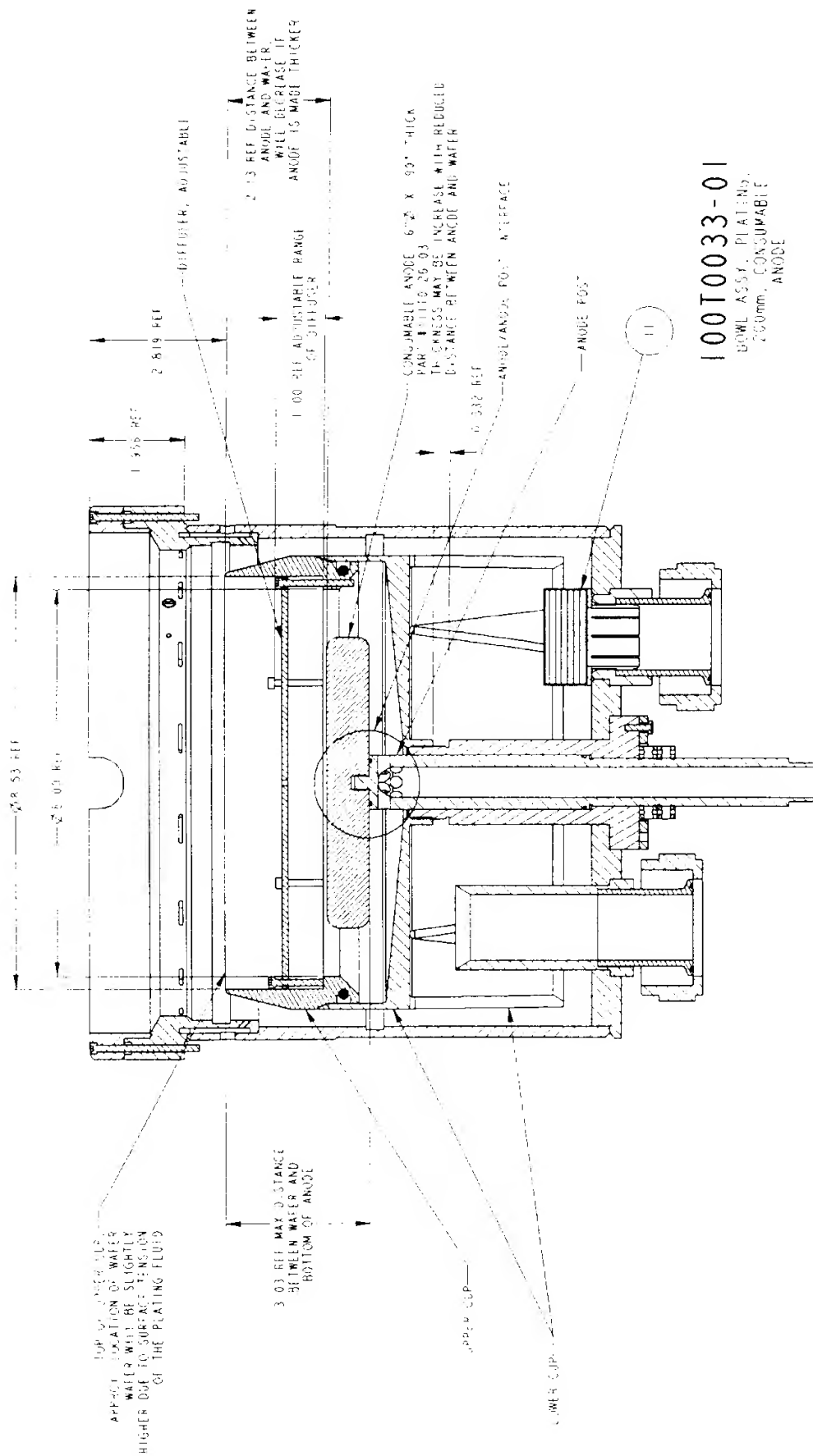
REVISIONS			
DESCRIPTION	DISPOSITION (SCRAP, REWORK, USE AS IS)	DATE	APPROV



NOTE: TWO SETS OF FOUR SPIRAL HOLE
PATTERNS EQUALLY SPACED.

TOLERANCES UNLESS NOTED
 XX = $\pm .020$
 XX = $\pm .010$
 ANGULARITY = $\pm .5^\circ$
 CHAMFER CORNERS = .010 MAX
 CHAMFER RADIUS = .015 MAX
 CHAMFER SURFACES
 DIMENSIONS ARE IN INCHES
 UNLESS NOTED

MATERIAL	NPP, SHEET 1/8"		
FINISH	-		
MODEL NO SHOWN	ATG0231		
SEMITOOL ™ KALISPELL, MT DIFFUSER, SERIES 2			
SIZE	FORM NO	DWG NO.	REV
B		ATG0231	
SCALE	0.500		SHEET 1 of 1



100T0033-01
BOWL ASSY. PLATING,
200mm. CONSUMABLE
ANODE

SECTION A-A

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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Date : October 4, 2001

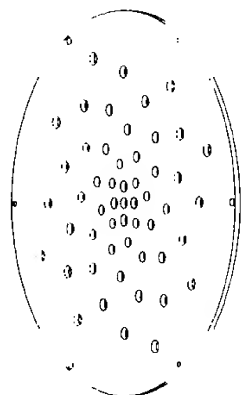
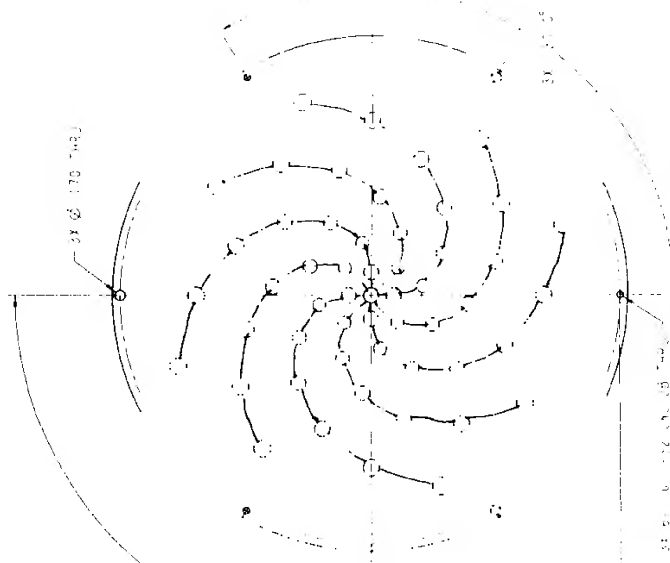
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EXHIBIT B

REV	DESCRIPTION	DATE
1	REVISED	11/1/55

4X Ø 250 THRU
 EQ SP ON A Ø 375 B C
 4X Ø 216 THRU
 EQ SP ON A Ø 375 B C
 4X Ø 231 THRU
 EQ SP ON A Ø 375 B C
 4X Ø 245 THRU
 EQ SP ON A Ø 375 B C
 4X Ø 258 THRU
 EQ SP ON A Ø 375 B C
 4X Ø 263 THRU
 EQ SP ON A Ø 375 B C
 4X Ø 231 THRU
 EQ SP ON A Ø 375 B C
 4X Ø 258 THRU
 EQ SP ON A Ø 375 B C
 4X Ø 263 THRU
 EQ SP ON A Ø 375 B C



SCALE 0 375

NOTE: TWO SETS OF FOUR SP 3A, HOLE PATTERN EQUALLY SPACED

DIFFUSER, SERIES 3	
ATG0232	REV 1

SEMITOOL PROPRIETARY

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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EXHIBIT C

PROMETRIX OmniMap RS30

FRIDAY NOV 21, 1997 11:05

SEMITHERM

PROCESS LAB

DISK ID: Semitherm

SCALE: 1.000

PROBE ID: 10458

RAW DATA LISTINGS: CONTOUR MAP

TITLE: .5 IN OPEN AREA DIFFUSER

FILE: 4898

TOTAL SITES: 121
GOOD SITES : 121
WAFER DIA. : 200.00 mm / 7.87 in
TEST DIA. : 184.00 mm / 7.24 in

MEAN : 13.24 m ohms/sq
STD DEV : 15.99 %
MINIMUM : 7.390 m ohms/sq
MAXIMUM : 15.46 m ohms/sq

WAFER ID. : D036A7 SLOT #21
LOT ID. : AMD (ST1 #363)
PROC. DATE : - -

CURRENT : MP/D 200.0mA 0.31mV
SORTING : 6.0 SIGMA

CIRCLE: 1

SITE VALUE	%DEV	SITE VALUE	%DEV	SITE VALUE	%DEV	SITE VALUE	%DEV
1 7.390m	-44.18	4 8.320m	-37.16	6 8.348m	-36.94	8 8.364m	-36.62
2 8.416m	-36.43	5 8.201m	-37.57	7 8.343m	-36.98	9 8.391m	-36.62
3 8.368m	-36.64						

CIRCLE: 2

SITE VALUE	%DEV	SITE VALUE	%DEV	SITE VALUE	%DEV	SITE VALUE	%DEV
10 10.30m	-22.20	14 10.27m	-22.43	18 10.30m	-22.20	22 10.33m	-21.97
11 10.35m	-21.82	15 10.26m	-22.50	19 10.28m	-22.35	23 10.34m	-21.90
12 10.31m	-22.12	16 10.25m	-22.58	20 10.33m	-21.97	24 10.40m	-21.45
13 10.33m	-21.97	17 10.25m	-22.58	21 10.37m	-21.67	25 10.39m	-21.52

CIRCLE: 3

SITE VALUE	%DEV	SITE VALUE	%DEV	SITE VALUE	%DEV	SITE VALUE	%DEV
26 12.83m	-2.719	32 12.61m	-4.758	38 12.50m	-5.589	44 12.65m	-4.456
27 12.63m	-4.229	33 12.57m	-5.060	39 12.56m	-5.136	45 12.71m	-4.003
28 12.76m	-3.625	34 12.54m	-5.297	40 12.63m	-4.607	46 12.72m	-3.927
29 12.66m	-4.380	35 12.50m	-5.589	41 12.64m	-4.531	47 12.55m	-5.211
30 12.57m	-5.060	36 12.47m	-5.815	42 12.66m	-4.380	48 12.70m	-4.078
31 12.65m	-4.456	37 12.50m	-5.589	43 12.71m	-4.003	49 12.83m	-3.096

CIRCLE: 4

SITE VALUE	%DEV	SITE VALUE	%DEV	SITE VALUE	%DEV	SITE VALUE	%DEV
50 14.53m	9.743	58 14.69m	10.95	66 14.35m	8.383	74 15.00m	13.29
51 14.49m	9.865	59 14.67m	10.80	67 14.47m	9.290	75 15.05m	13.67
52 14.73m	11.17	60 14.43m	8.987	68 14.72m	11.17	76 14.80m	11.78
53 14.38m	12.23	61 14.30m	8.006	69 14.86m	12.23	77 14.86m	12.23
54 14.75m	11.76	62 14.45m	9.138	70 14.81m	11.85	78 14.72m	11.17
55 14.53m	8.459	63 14.62m	10.42	71 14.73m	11.25	79 15.07m	13.82
56 14.50m	8.625	64 14.68m	10.87	72 14.68m	10.72	80 15.06m	13.74
57 14.50m	8.625	65 14.50m	10.95	73 14.65m	10.72	81 15.07m	13.82

CIRCLE: 5

<u>SITE VALUE</u>	<u>%DEV</u>	<u>SITE VALUE</u>	<u>%DEV</u>	<u>SITE VALUE</u>	<u>%DEV</u>	<u>SITE VALUE</u>	<u>%DEV</u>
82 13.98m	5.589	92 14.83m	12.00	102 14.05m	6.117	112 15.39m	16.23
83 13.86m	4.682	93 14.97m	13.06	103 14.12m	6.646	113 15.33m	15.78
84 14.53m	9.743	94 14.79m	11.70	104 14.95m	12.91	114 15.30m	15.55
85 15.03m	13.51	95 14.12m	6.646	105 15.27m	15.33	115 14.54m	9.818
86 15.07m	13.82	96 13.70m	3.474	106 15.46m	16.76	116 14.49m	9.441
87 14.96m	12.99	97 14.45m	9.139	107 15.39m	16.23	117 14.72m	11.17
88 14.61m	10.34	98 14.98m	13.14	108 14.97m	13.06	118 14.96m	12.99
89 14.07m	6.268	99 15.17m	14.57	109 14.79m	11.70	119 15.03m	13.51
90 14.14m	6.797	100 15.10m	14.04	110 14.60m	10.27	120 14.99m	13.21
91 14.74m	11.32	101 14.69m	10.95	111 15.13m	14.27	121 14.67m	10.80

PROMETRIX OmniMap RS30

FRIDAY NOV 21, 1997 09:24

SEMITHERM

PROCESS LAB

DISK ID: Semitherm

SCALE: 1.000

PROBE ID: 10458

RAW DATA LISTINGS: CONTOUR MAP

TITLE: .5 IN OPEN AREA DIFFUSER TAST WAFER

FILE: 4897

AMD LOT 363

TOTAL SITES: 49
GOOD SITES : 49
WAFER DIA. : 200.00 mm / 7.87 in
TEST DIA. : 184.00 mm / 7.24 in

MEAN : 13.35 m ohms/sq
STD DEV : 15.23 %
MINIMUM : 7.413 m ohms/sq
MAXIMUM : 15.44 m ohms/sq

WAFER ID. : D036A7 SLOT #21
LOT ID. : AMD (STI #363)
PROC. DATE : - - -

CURRENT : MP/D 200.0mA 0.31mV
SORTING : 6.0 SIGMA

CIRCLE: 1

SITE VALUE	%DEV	SITE VALUE	%DEV	SITE VALUE	%DEV	SITE VALUE	%DEV
1 7.413m	-44.47	4 9.626m	-27.89	6 9.686m	-27.44	8 9.687m	-27.43
2 9.726m	-27.14	5 9.590m	-28.16	7 9.691m	-27.40	9 9.723m	-27.16
3 9.656m	-27.44						

CIRCLE: 2

SITE VALUE	%DEV	SITE VALUE	%DEV	SITE VALUE	%DEV	SITE VALUE	%DEV
10 13.59m	1.797	14 13.36m	.0749	18 13.23m	-.8989	22 13.50m	1.123
11 13.44m	.6742	15 13.24m	-.8240	19 13.28m	-.5243	23 13.57m	1.647
12 13.36m	.0749	16 13.25m	-.7491	20 13.46m	.8240	24 13.43m	.5993
13 13.36m	-.6742	17 13.24m	-.8240	21 13.49m	1.043	25 13.41m	.4494

CIRCLE: 3

SITE VALUE	%DEV	SITE VALUE	%DEV	SITE VALUE	%DEV	SITE VALUE	%DEV
26 14.98m	5.093	32 14.97m	11.38	38 14.09m	5.543	44 15.43m	15.58
27 14.42m	6.015	33 14.95m	11.93	39 14.82m	11.01	45 15.27m	14.38
28 13.13m	13.43	34 14.03m	5.093	40 15.37m	15.13	46 14.58m	9.213
29 15.01m	12.40	35 14.49m	3.539	41 15.44m	15.65	47 14.77m	10.63
30 14.07m	5.093	36 15.13m	13.70	42 14.72m	10.26	48 15.12m	13.25
31 14.47m	6.099	37 15.07m	12.88	43 14.87m	11.38	49 14.94m	11.91

PROMETRIX OmniMap RS30

FRIDAY NOV 21, 1997 09:37

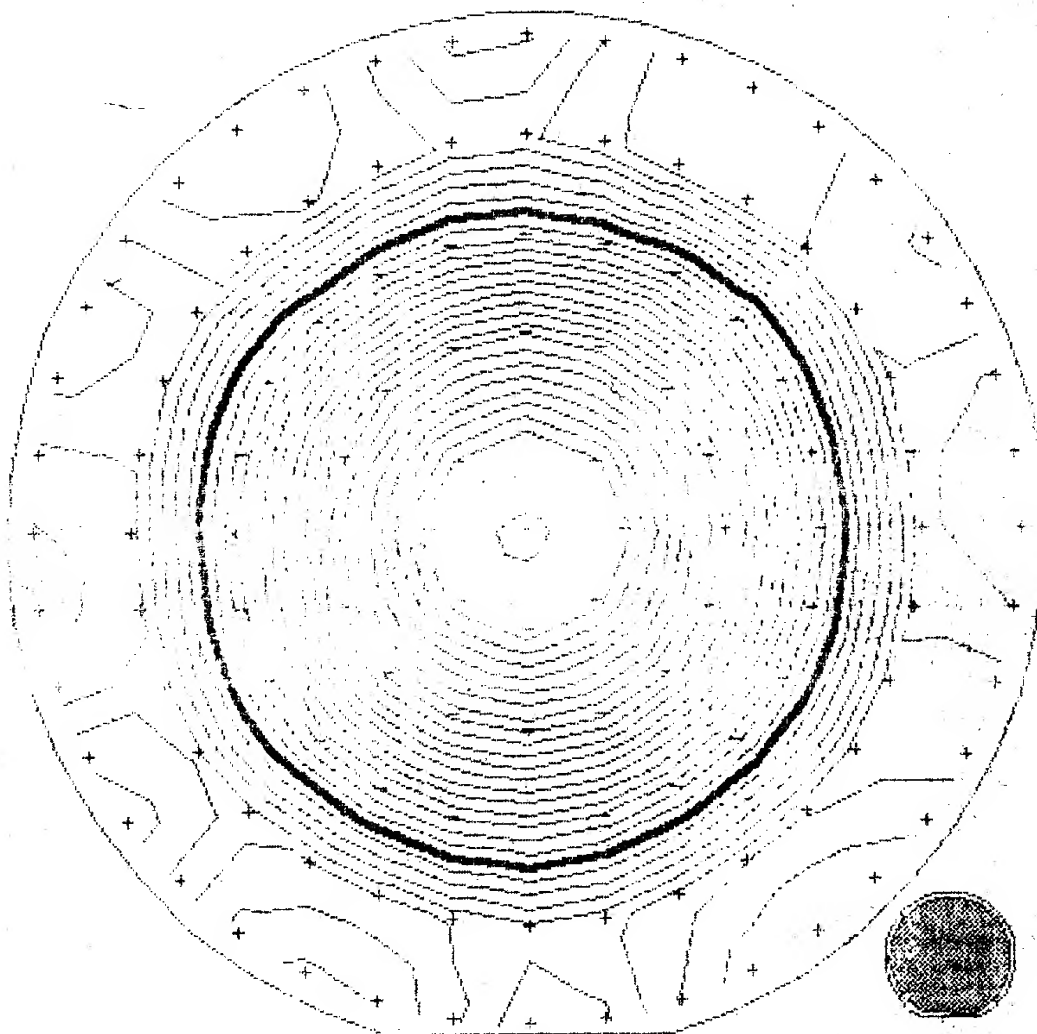
SEMITHERM

PROCESS LAB

DISK ID: Semitherm

SCALE: 1.000

PROBE ID: 10458



TITLE: .5 IN OPEN AREA DIFFUSER

FILE: 4898

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STD DEV : 15.99 percent
MINIMUM : 7.390 m ohms/sq
MAXIMUM : 15.46 m ohms/sq

MAP ID. : D036A7 SLOT #21
DOT ID. : AMD (STI #363)
PROC. DATE :
TEMPERATURE: 22.92C

INTERVAL : 2.00 percent
CURRENT : MP/D 200.0mA 0.31mV
SORTING : 6.0 SIGMA